

Claims:

1 1. An autocorrelator apparatus for measuring the distance from  
2 which light is reflected including:

3 a broadband light source for producing a first light beam;  
4 a fiber light probe connected to receive the first light beam  
5 and shine it on a structure that reflects at least a portion of  
6 the first light beam as a second light beam into said fiber light  
7 probe;

8 a first optical fiber;

9 a second optical fiber, said second optical fiber having the  
10 near identical light path length as said first optical fiber;

11 first fiber means for splitting the second light beam into  
12 third and fourth light beams into said first and second optical  
13 fibers respectively;

14 a first fiber stretcher to vary the optical path length of  
15 said first optical fiber;

16 a first reflector positioned to reflect the third light beam  
17 back through said first optical fiber and said first fiber  
18 stretcher as a fifth light beam;

19 a second reflector positioned to reflect the fourth light  
20 beam back through said second optical fiber as a sixth light beam,  
21 said first fiber means combining the fifth and sixth light beams  
22 into a seventh light beam; and

23 a first optical receiver positioned to receive intensity  
24 variations in the seventh light beam and a signal representative  
25 of the variation in light path length of said first optical fiber  
26 and to produce therefrom indications of the displacement of  
27 reflections of the first light beam from said fiber light probe.

1 2. The autocorrelator apparatus as defined in claim 1 further  
2 including:

3 a second fiber stretcher to vary the optical path length of  
4 said second optical fiber opposite from the variation of the  
5 optical path length of said first optical fiber.

1        3. The autocorrelator apparatus as defined in claim 1 wherein  
2 said first fiber means include:  
3        a single mode fiber coupler, and wherein said first and  
4 second fibers are single mode fibers.

1        4. The autocorrelator apparatus as defined in claim 1 wherein  
2 said first fiber means include:  
3        a fiber coupler.

1        5. The autocorrelator apparatus as defined in claim 1 wherein  
2 said first fiber means include:  
3        a single mode fiber coupler, wherein said first and second  
4 fibers are single mode fibers, and wherein said first and second  
5 reflectors are Faraday rotator mirrors.

1        6. The autocorrelator apparatus as defined in claim 1 further  
2 including:  
3        a coherent light source for producing an eighth light beam of  
4 a wavelength frequency different from the first light beam;  
5        means to couple the eighth light beam into said first and  
6 second optical fibers so that said first and second reflectors  
7 reflect ninth and tenth light beams therefrom which are combined  
8 at said first fiber means into an eleventh light beam;  
9        a second optical receiver positioned to detect fringe  
10 variations of the eleventh light beam to determine the exact  
11 displacement of the scan of the first fiber stretcher at all  
12 points in its sweep.

1        7. The autocorrelator apparatus as defined in claim 6 further  
2 including:  
3        a wavelength sensitive device connected to said first fiber  
4 means to direct the seventh light beam to said first optical

5 receiver and the eleventh light beam to said second optical  
6 receiver.

1 8. The autocorrelator apparatus as defined in claim 2 further  
2 including:

3 a coherent light source for producing a eighth light beam of  
4 a wavelength different from the first light beam;

5 means to couple the eighth light beam into said first and  
6 second optical fibers so that said first and second reflectors  
7 reflect ninth and tenth light beams therefrom which are combined  
8 at said first fiber means into an eleventh light beam;

9 a second optical receiver positioned to detect fringe  
10 variations of the eleventh light beam to determine the exact  
11 displacement of the scan of said first fiber stretcher at all  
12 points in its sweep.

1 9. The autocorrelator apparatus as defined in claim 8 further  
2 including:

3 a wavelength sensitive device connected to said first fiber  
4 means to direct the seventh light beam to said first optical  
5 receiver and the eleventh light beam to said second optical  
6 receiver.

1 10. An apparatus for measuring the distance from which light is  
2 reflected including:

3 a broadband light source for producing a first light beam;

4 a first fiber light probe connected to receive the first  
5 light beam and shine it on a structure that reflects at least a  
6 portion of the first light beam as a second light beam into said  
7 fiber light probe;

8 a first fiber stretcher through which the second light beam  
9 is passed back and forth to controllably modulate the second light  
10 beam; and

11 a first optical receiver positioned to receive intensity  
12 variations in the modulated second light beam and a signal  
13 representative of the variation in light path length of said first  
14 optical fiber and to produce therefrom indications of the  
15 displacement of reflections of the first light beam from said  
16 fiber light probe.  
17

1 11. The apparatus as defined in claim 10 further including:  
2 a second fiber stretcher through which the second light beam  
3 is passed back and forth to controllably modulate the second light  
4 beam opposite from the first light beam.

1 12. The apparatus as defined in claim 11 further including:  
2 a polarizer through which the first light beam is passed for  
3 establishing a polarization thereof; and  
4 polarization preserving optical fiber through which the  
5 polarized first light beam and the second light beam are passed.

1 13. The apparatus as defined in claim 10 further including:  
2 a first Faraday rotator mirror positioned to reflect the  
3 second light beam back though said first fiber stretcher.

1 14. The apparatus as defined in claim 11 further including:  
2 further including:  
3 a first Faraday reflector positioned to reflect the second  
4 light beam back though said first fiber stretcher; and  
5 a second Faraday reflector positioned to reflect the second  
6 light beam back though said second fiber stretcher.

1 15. An autocorrelator apparatus for measuring the distance from  
2 which light is reflected including:

3 a broadband light source for producing a first light beam;  
4 a fiber light probe connected to receive the first light beam  
5 and shine it on a structure that reflects at least a portion of  
6 the first light beam as a second light beam into said fiber light  
7 probe;  
8 a first optical fiber;  
9 a second optical fiber, said second optical fiber having the  
10 near identical light path length as said first optical fiber;  
11 first fiber coupler for splitting the second light beam into  
12 third and fourth light beams into said first and second optical  
13 fibers respectively;  
14 a first fiber stretcher to vary the optical path length of  
15 said first optical fiber;  
16 a first reflector positioned to reflect the third light beam  
17 back through said first optical fiber and said first fiber  
18 stretcher as a fifth light beam;  
19 a second fiber stretcher to vary the optical path length of  
20 said second optical fiber;  
21 a second reflector positioned to reflect the fourth light  
22 beam back through said second optical fiber and said second fiber  
23 stretcher as a sixth light beam, said first fiber means combining  
24 the fifth and sixth light beams into a seventh light beam; and  
25 a first optical receiver positioned to receive intensity  
26 variations in the seventh light beam and to produce therefrom  
27 indications of the displacement of reflections of the first light  
28 beam from said fiber light probe.

1 16. The autocorrelator apparatus as defined in claim 15 wherein  
2 said first fiber means include:

3 a single mode fiber coupler, and wherein said first and  
4 second fibers are single mode fibers.

1 17. The autocorrelator apparatus as defined in claim 15 wherein  
2 said first fiber means include:

3 a single mode fiber coupler, wherein said first and second  
4 fibers are single mode fibers, and wherein said first and second  
5 reflectors are Faraday reflectors.

1 18. The autocorrelator apparatus as defined in claim 15 further  
2 including:

3 a coherent light source for producing an eighth light beam of  
4 a wavelength different from the first light beam;

5 means to couple the eighth light beam into said first and  
6 second optical fibers so that said first and second reflectors  
7 reflect ninth and tenth light beams therefrom which are combined  
8 at said first fiber means into an eleventh light beam;

9 a second optical receiver positioned to detect fringe  
10 variations of the eleventh light beam to determine the exact  
11 displacement of the combined scan of said first and second fiber  
12 stretchers at all points in their combined sweep.

13 19. The autocorrelator apparatus as defined in claim 18 further  
14 including:

15 a wavelength sensitive device connected to said first fiber  
16 means to direct the seventh light beam to said first optical  
17 receiver and the eleventh light beam to said second optical  
18 receiver.

1 20. The autocorrelator apparatus as defined in claim 17 further  
2 including:

3 a coherent light source for producing an eighth light beam of  
4 a wavelength different from the first light beam;

5 means to couple the eighth light beam into said first and  
6 second optical fibers so that said first and second reflectors  
7 reflect ninth and tenth light beams therefrom which are combined  
8 at said first fiber means into an eleventh light beam;

9 a second optical receiver positioned to detect fringe  
10 variations of the eleventh light beam to determine the exact

- 11 displacement of the combined scan of said first and second fiber
- 12 stretchers at all points in their combined sweep.

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